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GOVERNMENT CONSTRUCTION OF IRRIGATION WORKS.

FOR the past ten or twelve years there has been a growing demand that the government aid in the construction of irrigation works for the reclaiming of the arid lands of the West. This demand was endorsed by both the great political parties in their last platforms, and culminated in 1901 in the defeat of the river and harbor bill in the United States Senate, and has during the last session of Congress resulted in a combination of western representatives for the purpose of forcing that body to recognize the demands of the West in this regard. At the opening of the last session of Congress, the movement for the first time received the endorsement of the president of the United States in his annual message. Politically, the movement has, therefore, all the endorsement which could be asked by the most exacting partisan. But in the literature on the subject the economic and legal phases of the question have been generally avoided. It is the purpose of this paper to discuss some of these neglected phases of the general subject of government construction of irrigation works, and more particularly of the plan recommended by the president, and that formulated in the "irrigation bill" as it passed the United States Senate during the present session of Congress.

The general proposition is that the usual flow of most of the streams in the arid region is used on lands already under cultivation, but that large volumes of water run to waste during the winter and the flood period of early summer, and that this water which now runs to waste should be stored. Further, some of the large rivers, notably the Missouri, the Colorado, and the Columbia, have been little used for irrigation because of the difficulty of getting the water out of them onto the high lands which confine these streams to narrow channels. The work of storing the waste waters, and of placing the water of the streams like

those mentioned within the reach of settlers, has been declared to be beyond the power of private enterprise, and, therefore, the duty of the government. President Roosevelt states the case as follows :

Great storage works are necessary to equalize the flow of streams and to save the flood waters. Their construction has been conclusively shown to be an undertaking too vast for private effort. . . . The government should construct and maintain these reservoirs as it does other public works. . . . The reclamation of the unsettled arid lands presents a different problem. Here it is not enough to regulate the flow of streams. The object of the government is to dispose of the land to settlers who will build homes upon it. To accomplish this object water must be brought within their reach. . . . These irrigation works should be built by the national government. The lands reclaimed by them should be reserved by the government for actual settlers, and the cost of construction should, so far as possible, be repaid by the land reclaimed. The distribution of the water, the division of the streams among irrigators, should be left to the settlers themselves in conformity with state laws and without interference with those laws or with vested rights.¹

The following table, showing the average monthly discharge of the Arkansas river at Cañon City, Col., brings out the necessity for equalizing the flow of streams mentioned by President Roosevelt :

AVERAGE MONTHLY DISCHARGE OF ARKANSAS RIVER AT CAÑON CITY, COL., 1898.²

	Cubic feet per second.		Cubic feet per second.
January - - - -	270 ³	July - - - -	1,613
February - - - -	350 ³	August - - - -	326
March - - - -	338 ³	September - - - -	189
April - - - -	393 ³	October - - - -	228
May - - - -	909	November - - - -	302
June - - - -	2428	December - - - -	350 ³

This table shows the general character of the streams used for irrigation. The flood is sometimes earlier or later, and in some years lasts longer than in others, depending on weather conditions in the drainage area of the stream.

¹ *Message to Congress*, beginning of first session Fifty-seventh Congress.

² From *Twentieth Annual Report, U. S. Geological Survey*, Part IV, p. 325.

³ Approximate.

The crops which can be raised by the use of a stream depend very largely on the character of its flow, and in general the value of the crop varies with the length of time which it requires to be watered. With water only during flood-time the farmer is limited to raising wild hay, which gives a return of perhaps \$5 per acre; with water in May, June, and July, he may raise grain and two crops of alfalfa, which may bring him from \$15 to \$20 per acre; with water in August, as well as the preceding months, he may raise potatoes and sugar beets, and a third crop of alfalfa, increasing his returns to \$30 to \$100 or more per acre; and with water later in the season he may plant orchards which will yield still larger returns. Assuming that one cubic foot per second will serve 100 acres, a liberal estimate, the Arkansas river in 1898 would have matured 32,600 acres of crops requiring water in August, while it would have raised 242,800 acres of native hay. If an average of say 500 cubic feet per second could be stored during June and added to the flow of the river in August an area of 50,000 acres which had been devoted to native hay, yielding \$5 per acre, could be planted to crops yielding from \$30 to \$100 per acre. The particular products named above are not raised in all parts of the West, but serve to illustrate the general principle. Again, the return from native hay will not justify any considerable outlay for bringing water to the land, and much of the flood would be allowed to go to waste if not stored, as will the winter flow of the stream. Storage will, therefore, increase the area irrigated, but its greatest advantage is in making it possible to raise high-priced products.

The construction of these storage works has been stated to be beyond the power of private effort. Although this statement appears in countless resolutions by conventions, platforms, reports, and hearings before committees of Congress, the writer has never seen one fact stated in support of the contention or one argument to prove it. It seems to be considered a self-evident proposition. It is true that a great many irrigation companies have been financial failures, but this has been equally true of companies in every other line of business, especially

during the hard times which we recently passed through. It is only fair to suppose that some of the failures of irrigation companies were due to the general depression which affected all lines of business. But the most frequently assigned cause for the failure of companies building irrigation works for the purpose of furnishing water to farmers has been the failure to get settlers under the canals to whom to deliver water. They tried to force development beyond the demand for the lands, and failed. The capital invested was, therefore, unproductive, and investors soon learned that irrigation was a good thing to let alone. Irrigation districts were organized in California for the purpose of obtaining money by issuing bonds based on the property of the districts. These failed largely because of frauds in their organization, which have ever since given a bad name to irrigation securities of all kinds, making it hard to borrow money for such works. Whether they would have failed if honestly conducted has not been demonstrated. But meantime construction has been going on. The farmers on the eastern slope of the Rocky Mountains in Colorado have built reservoirs enough to hold the floods of ordinary years, and have more under construction which will hold all except the most extraordinary floods. On the west side of the range in Colorado reservoirs are not yet needed, as the streams furnish more water than is used. In Wyoming one of the largest reservoirs in the West has been built within the past few years, and in the northern part of that state the construction of large canals has been going on continuously for several years. Construction of both reservoirs and canals has been going on in Utah, and farmers who feel the need of late water are taking steps to provide it. In the summer of 1901 the irrigators along the Jordan River in that state held meetings and appointed committees to investigate the various possible ways of increasing their water supply preliminary to taking steps to that end. During the same summer the people of the Salt River valley in Arizona had similar meetings, and spent considerable money in preliminary work, and are now trying to get through Congress a bill which will allow them to lend

the credit of some of their counties to reservoir construction. They are not asking the government to build their works, but are simply asking permission to do it themselves. During the past year several irrigation companies have been organized in New Mexico. From all this it appears that the impotency of private effort is at least open to serious question. But the real question is not *the necessity* for government construction. There can be no absolute necessity for it, because the work can be left undone, leaving conditions as they are, if the people of the West are unable to improve them. The question then comes back to *the expediency* of government construction.

The whole question of the development of the arid West would be greatly simplified if that region were wholly undeveloped, and no rights had been vested and no customs established. But when that condition existed the future importance of the region was not appreciated. The result is that whatever is now done must be done subject to existing rights, and, in a large measure, in conformity with existing laws. Under the present conditions the government may proceed along three lines: (1) The government may, like private land-owners, provide water to irrigate its own lands; (2) the government may appropriate water for "sale, rental, or distribution;" (3) there would seem to be nothing to prevent the government building reservoirs and turning the water into the streams, to be taken out below, the same as if it were a part of the natural flow of the stream; or to prevent its building canals from which water could be appropriated as if they were natural streams. In the following pages the attempt is made to show what would be the results of following any one of these courses.

GOVERNMENT CONSTRUCTION TO RECLAIM GOVERNMENT LANDS.

All the land in the arid region, with the exception of that in Texas, and that included in Spanish and Mexican land grants, was at one time the property of the government. This land has been disposed of in three ways: By patent to settlers under the homestead, pre-emption, desert land, and mining laws; by

grant to the several states and territories for educational and other purposes; and by grant as subsidies to railroad and wagon road companies. But large areas are still in government ownership. From natural causes most of the land which has been disposed of lies along the streams. As settlers cannot live without a water supply, the land taken up by them must be within the reach of the streams, while within the mountainous areas the only lands which can be cultivated, regardless of the water supply, are in the valleys of the streams. For equally good reasons the railroads have, as a rule, followed the streams, and their grants include the alternate sections for given distances on both sides of their tracks. Some of the grants to the states and territories have included certain sections in all townships (usually sections 16 and 36), but in many grants the state is allowed to choose the lands, and naturally chooses the more valuable tracts. In this way it happens that, while the greater part of the land in some states is still in government ownership, a large part of the cultivable land within reach of the streams is in private, corporate, or state ownership. Assuming, however, that there is government land which can be reached by water from the streams of the arid region, most of these streams are already in use for irrigating private lands. Where these private lands use the entire stream, both ordinary and flood flow, as in eastern Colorado, there is, of course, no water for the government to appropriate, and its lands must be used for grazing. Where the ordinary flow only is used for private lands, the government can obtain a supply of water by storing the floods. As pointed out above, without storage the greater part of the land watered from a stream is necessarily devoted to crops which bring a low return. Now, if the government comes in and stores the water and reclaims new lands, these private lands are forever condemned to the comparatively primitive agriculture which is possible without a late water supply. The history of the Union Colony at Greeley, Col., and of other sections, shows that the farmers will in the natural course come to a time when they will provide themselves with means for storage. But in the case

above assumed they will be shut out from this, because the water has already been stored and applied to other lands. While there is no legal obstacle in the way of such a course on the part of the government, justice would seem to demand that the owners of private lands should not be deprived of the possibility of improving their conditions. Stored water has its greatest value as a supplement to an existing supply, and used in that way will produce far greater returns than when used on lands which have no other supply. An acre-foot of water used to finish a crop of potatoes will produce a value of probably \$100 more than could be produced by the land if it was without that water, while the same quantity used on land which has no other supply will produce a value of perhaps \$5. Both justice and economy demand, then, that where the lands already under cultivation need the water of a stream the government should not take it to reclaim new lands.

There is another class of streams—those along which there is both public and private land which can be reclaimed, and in which there is unappropriated water. In such a case there would be no difference, as far as public considerations are concerned, whether the water is used on public or private lands, since the public lands will at once pass to private ownership. If the government should take all the water there would be a certain injustice to private owners, as in the other cases, since they would be permanently shut out from improving their lands.

GOVERNMENT CONSTRUCTION FOR SALE, RENTAL, OR DISTRIBUTION.

In all the arid states water may be taken from the streams by individuals or corporations for distribution to others than the owners of the works. There are some theoretical distinctions as to whether the charges made for this delivery are for the carrying of the water or for the water itself. In practice this makes no particular difference. It costs the farmer a certain amount to get the water to his field, and it does not reduce this charge any to call it a toll for delivery rather than a price for the water. It is fair to suppose that no state would raise any objection to

the government taking water from its streams under these general laws. The water could then be delivered to consumers, either owners of private lands or homesteaders on the public lands, for the price fixed by law, by agreement, or, in some states, by the county commissioners. This is the plan contemplated in the irrigation bill (S. B. 3057) passed by the United States senate March 1, 1902. Section 4 of that act is in part as follows :

That upon the determination by the secretary of the interior that any irrigation project is practicable, he shall give public notice of the lands irrigable under such project, and limit of area per entry, which limit shall represent the acreage which, in the opinion of the secretary, may be reasonably required for the support of a family upon the lands in question ; also of the charges which shall be made per acre upon the said entries, and upon lands in private ownership which may be irrigated by the waters of the said irrigation project, and the number of annual installments, not exceeding ten, in which such charges shall be paid and the time when such payments shall commence, the said charges to be determined with a view of returning to the reclamation fund the estimated cost of construction of the project.

Section 6 further provides :

That when the payments required by this act are made for the major portion of the lands irrigated from the waters of any of the works herein provided for, then the management and operation of such irrigation works shall pass to the owners of lands irrigated thereby, to be maintained at their expense under such form of organization and under such rules and regulations as may be acceptable to the secretary of the interior.

This plan is not open to the objection raised against government construction for government lands, that it will deprive private owners of the opportunity to improve their lands since it includes the furnishing of water to such lands. As in the former case, no opportunity for any works would arise on those streams already fully utilized. On streams where the ordinary flow is all used, but where there is flood water open to appropriation, the water made available should be supplied first to the lands already under cultivation, and if there is a surplus it can go to reclaim other lands either public or private. The latter section quoted provides for turning the works over to the users of the water when the charges made against the major portion of the lands to

be irrigated are paid. On such streams as those under consideration, government construction under this bill will simply amount to a loan to the irrigators on the stream, on ten years' time. It will no doubt help them to raise much more valuable crops, but there would seem to be no reason for thus helping one class of farmers, or the farmers in one locality, to do what others with no better opportunities have done for themselves, and what these can do for themselves without the aid of the government.

Along streams where there is unappropriated water and lands to which this water can be brought, the situation will not be materially changed from that now existing. The plan proposed is the one which has been quite generally followed by canal companies. These companies have built their works and sold water rights for prices which were supposed to repay the cost of construction, with a profit, and have charged an annual maintenance tax which pays for operating and maintaining the works. When a certain proportion of their water rights are sold the works are turned over to the purchasers to be operated by them. Some of these canal companies have owned the lands to be reclaimed and some have built works to water government lands. The water rights are sold on long time and easy terms. There are canals now in operation, with plenty of water and plenty of unreclaimed land, offered under the most liberal terms, which cannot get settlers, although agents are constantly in the field trying to secure them. The plan outlined in the bill provides that the settlers shall repay the cost of construction, and that is what they have been unable to do under the private canals, or what they think they cannot do. The argument urged in favor of such construction by the government is that it is no great hardship if the cost is not returned to the government for many years, and that the general benefit will justify the expenses; while private capital gets no return from the general good, and must therefore, sell its water rights within a limited time or fail. The canal companies have generally been financial failures, but settlement under them has gone on gradually, and successfully from the standpoint of all but the investors. This settlement

has, however, been extremely slow. There is no apparent reason why the development under government works would be more rapid. It would, however, be going on over a larger range of territory, and the whole result would be greater.

The great cry of the promoters of government construction has been the making of homes on the government lands for those of our population who have nothing with which to obtain homes but their ability and willingness to work. As stated above, a large part of the lands which can be reached has passed from the control of the government; it has also been pointed out that there are lands with a water supply provided, which can be had by these people on as easy terms as will be asked by the government under the proposed plan. As a measure for disposing of the public lands, or for providing cheap homes, the bill as passed by the senate has nothing to recommend it. As an aid to the gradual development of the West, it will doubtless succeed unless the slowness of the progress made leads to such a change of sentiment in Congress as will cause works to be left to go to ruin after being begun.

FREE GOVERNMENT WORKS.

The third plan under which the government may undertake irrigation works is the building of reservoirs on the headwaters of streams, and the turning of the stored water into the streams during times of low water, to be taken out under existing rights or to be appropriated under existing state laws; and the building of canals from which water may be taken as though they were natural streams.

This is the plan as to reservoirs recommended by President Roosevelt in his message:

Where their purpose (reservoirs built by the government) is to regulate the flow of streams, the water should be turned freely into the channels in the dry season to take the same course under the same laws as the natural flow.

This recommendation leads to the discussion of existing rights to water. In all the arid states rights are decreed in terms

of a "continuous flow."¹ That is, a canal company or an individual is decreed to have a right to take a given volume of water, say ten cubic feet per second, from a stream, continuously, or whenever it is needed. On most streams where rights have been adjudicated, the sum of all these decrees far exceeds the discharge of the stream. As an instance, the existing decreed rights to water from the Arkansas river, for which the flow is given above, amount to 4,972 cubic feet per second, while the maximum average flow for any month given is 2,428 cubic feet per second, or just about half the decreed amount. Water is distributed in this way: The person having the first right takes water up to the amount of his decree whenever it is needed; the holder of the second right does the same whenever there is more than enough water for the first right, and so on down the list. During flood period each takes all he wants, and as the supply becomes less the appropriators are cut off in order, beginning with the latest. At the time the decree referred to was made, there was more water in the stream during flood periods than was needed. Supposing the government had then built reservoirs to store this surplus, and turned the water into the stream during low water, it would have been divided in accordance with the decrees referred to, and might have been all taken by those having the earlier decrees, leaving the holders of more than half the rights no better off than they were before. Those receiving the benefit would have done nothing more than their neighbors, and would be no more deserving of this gift from the government. Where this work is done by private parties the opportunity is open to all, and the one who gets stored water pays the price; and the same would be true under government construction under the bill passed by the senate, although a question as to who should be first entitled to acquire rights might arise in the latter case if the demand exceeds the supply when the works are built. Otherwise the water will be disposed of on the principle of "first come first served," the recognized principle in the acquirement of water

¹ In Utah rights are often decreed to parts of a stream, or to part or all of a stream, for stated lengths of time.

rights. Canal companies have built reservoirs to store most of the flood waters of the Arkansas river, but the situation above assumed represents that existing on most of the streams of the arid region. In all the states, with the possible exception of Wyoming, the companies or individuals receiving this benefit could sell the rights to this new supply of water to their less fortunate neighbors, and in this way, while the efficiency of the stream would be increased, the great benefit would go to the holders of early rights, who need it the least and are best able to supply the water for themselves. As to making cheap homes, or reclaiming government lands, this class of works would be entirely devoid of results.

On streams, the ordinary flow of which has not been used as yet, there is naturally no call for the construction of reservoirs. It has been proposed that the government build canals from the larger rivers which have not been extensively used for irrigation, to reclaim lands where the prospective returns from the lands will not pay the cost of construction; these canals to be treated as natural streams, so far as acquiring rights to water are concerned. Under this system a stream would necessarily be treated as a whole, and a diversion from a canal would be considered a diversion from the stream. In all the arid states except Wyoming and Nebraska the course necessary to obtain a right to take water from a stream is to build a canal and put the water to a beneficial use. In practice, "beneficial use" includes sale or distribution to others, and among appropriators the first in time, is the first in right. There are provisions regarding posting and filing notices stating what is claimed, place of intended diversion, means of diversion, etc., but the only effect of posting and filing these notices is to date the right back to the time of posting rather than to the time of beginning construction, or of putting the water to a beneficial use. In Wyoming and Nebraska rights are initiated on application to state authorities and vested when the works are completed in accordance with permits issued by those authorities, but in all the states, as previously stated, rights to water for delivery to others may be acquired. There

is, therefore, no assurance under existing laws that the water thus brought within the reach of lands needing reclamation will go directly to farmers of small tracts, but the water may go to individuals or canal companies to be by them sold to farmers. In fact, this would probably be the outcome, because, even after the main canals have been built, the individual farmer cannot bear the expense of bringing the water to his land independently. Distributing canals covering several farms each are necessary, and these must be built in advance of settlement.

The carrying out of this plan, like the others discussed, would undoubtedly result in the gradual reclamation of considerable areas of land, but, like the others, would not make homes within the reach of the poor man, nor reclaim any great areas of public lands, as the present owners of lands would naturally be the first to appropriate the water, since they have only that expense, while those taking it for public lands, have also the expense of acquiring the lands.

In the preceding discussion the subject has been treated as if it were possible to tell just what the existing rights to the streams of the West are. In but two states, Wyoming and Nebraska, is this possible, and in those states only on streams entirely within either state. Attention has been called to the decreed rights to water from Arkansas river. Those decrees include only rights in Colorado, and there are canals taking water from the stream in that state which are not included, while the use of the stream in Kansas is entirely neglected by the courts making the decrees. Add to this the fact that the volume decreed is twice as much as the stream ever carries for more than a few days at a time, and it will be seen that the decrees, which are the only record of existing rights, show little as to the actual state of affairs. Again, existing rights cannot be determined by measuring the streams and the canals taking water from them, or the land irrigated. A canal may have a decreed right to ten times as much as it is carrying, or may be carrying ten times as much as it has a decreed right to, and might be able to establish its right to this larger volume as against a later claimant. A canal may be built

to reclaim fifty thousand acres of land, and be granted a right to sufficient water for that area, provided it is brought under cultivation within ten years. This is the plan followed under the "Carey Act" granting lands to states in aid of irrigation. Such a canal might be watering one thousand acres at the time of measurement, and might ultimately establish its right to only a half or a third of the volume allowed to it conditionally. Except in the states named the practice is to build canals where there is thought to be unappropriated water, and use whatever can be secured until someone complains of this use and applies to the courts for redress. The matter will then be taken up by the courts, and canal builders may find that they have rights to plenty of water, and they may find that they have no rights whatever. But there is no way in which this can be determined before the canals are built. As has been stated, Wyoming and Nebraska grant rights to streams, and here prospective builders of irrigation works may, by inquiry, find out just what water may be acquired from any stream. There are localities where it is a well-known fact that there is no water left in the streams, and others where it is equally well known that there is a surplus of water, but a great many streams lie between these extremes.

CONCLUSIONS.

A large part of the lands which can be reached by canals from the streams of the arid region are in private, corporate, or state ownership.

The inability of private enterprise to construct reservoirs and canals has not been demonstrated.

The construction by the government of irrigation works for public lands, exclusively, would be unjust to the owners of lands needing the water.

Where the flood waters are needed for lands already under cultivation it would be unjust and wasteful for the government to store and use the waters for new lands.

The plan proposed by the senate is the plan which has been followed by canal companies, and there is no reason to look for

greater success. It would probably result in the gradual but slow development of the West up to the extent of the water supply. In settled localities it would amount to no more nor less than a loan to farmers on ten years' time, and would reclaim no new lands.

Under existing laws there are not sufficient safeguards against monopoly and extortion to justify the building of free government works, either reservoirs or canals.

No plan but that of free government construction, for the exclusive use of government lands, which is both unjust and wasteful, will make cheap homes, or insure the reclamation of any large area of public lands.

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